

DOCUMENT RESUME

ED 237 321

SE 043 405

AUTHOR Andersson, Lillemor, Ed.
TITLE Science Subjects--An Evaluation of Student Achievement and Attitudes in International Perspective. (IEA Science II).
INSTITUTION Skolverstyrelsen National Board of Education, Stockholm (Sweden).
PUB DATE Aug 83
NOTE 10p.
PUB TYPE Reports - Descriptive (141)
JOURNAL CIT Newsletter School Research; n1983:3 Aug 1983
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Achievement; Curriculum Development; Decentralization; *Educational Trends; Elementary School Science; Elementary Secondary Education; Foreign Countries; *Research Design; Research Needs; *Science Education; Secondary School Science; Sex Differences; *Student Attitudes
IDENTIFIERS *Science Education Research; *Sweden

ABSTRACT

Because of changes in the Swedish educational system (including formation of a new upper secondary school), as well as changes in other countries, the International Association for the Evaluation of Educational Achievement (IEA) is undertaking a new science study to provide evidence for policymaking and for better understanding the teaching/learning processes and the factors which influence outcomes. The international study has three main goals, namely, to describe (1) increased decentralization which has occurred in many countries in recent years, and to study the consequences that this decentralization can have; (2) changes which have occurred in many countries in recruitment to primary and upper secondary schooling; and (3) student achievement in science and attitudes toward science, and to compare achievement levels and attitudes with the first IEA study. Specific goals of the Swedish study include: outline developments since 1970 in curriculum and student achievement/attitudes; examine effects of implementation of new science curricula in compulsory and upper secondary schooling; evaluate competence levels in basic science knowledge; examine knowledge related to requirements of different "users" of scientific/technical manpower; investigate student attitudes toward science/schools; study sex differences in achievement/attitudes; investigate relationship between instructional factors and student achievement/attitudes; and make international comparisons concerning student achievement/attitudes. (JN)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

Newsletter SCHOOL RESEARCH

August 1983

Current project

1983:3

ED237321

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

✓ This document has been reproduced as
received from the person or organization
originating it.

Minor changes have been made to improve
reproduction quality.

• Points of view or opinions stated in this docu-
ment do not necessarily represent official NIE
position or policy.

Titel of project	Science Subjects - An Evaluation of Student Achievement and Attitudes in International Perspective (IEA Science II)
Project no.	6303
In progress at	Institute of International Education University of Stockholm S-106 91 STOCKHOLM Tel. 08-16 20 67
Tutor	Assoc. Prof. Richard Noonan
Project leader	Assoc. Prof. Richard Noonan

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

Skolöverstyrelsen
National Board of Ed.

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

SE043405

Postal address
S-106 42 STOCKHOLM
Sweden

Office address
Karlavägen 108

Telephone
08 - 14 06 60

2

Editor ISSN
Lillemor 0345-5343
Andersson

NEWSLETTERS 1979, 1980, 1981, 1982 and 1983.

No.	Title
1979:1	Social segregation in comprehensive schools in Sweden
1979:2	Pedagogics and the school environment
1979:3	Elementary School Studies for Adults
1979:4	The NBE and School of Education Development Study (SLU)
1979:5	School-home-leisure
1979:6	List of Projects 1979/80
1979:7	Internationalization in popular education (INFA)
1980:1	Pupils' thinking and course requirements in science teaching (EKNA)
1980:2	Marks and assessments in school
1980:3	Continuous admissions at AMU centres (SINAMU)
1980:4	Follow-up of school management training (USU)
1980:5	Special pedagogics in pre-school education (SIF)
1980:6	Problem-oriented co-operation between teachers, pupils and parents (POSLEF)
1980:7	List of Projects 1980/81
1980:8	Evaluation of an experimental SYO organization
1980:9	Models for the bilingual instruction of immigrant children
1981:1	Integration of the profoundly deaf and severely hearing impaired in ordinary classes
1981:2	The PANG Project. Process Analysis of Non-Grading.
1981:3	Preconditions of change in schools (FISK)
1981:4	Social segregation in comprehensive schools in Sweden.
1981:5	H.G. Macintosh. Report on a visit to Sweden.
1981:6	Learning problems of junior level children - a Nordic joint research project
1981:7	Needs-oriented language learning for adults (BISVUX)
1981:8	List of projects 1981/82
1981:9	Teaching processes - world conception and Educational Vocational Guidance (SIA-SYO)
1981:10	Swedish science subjects in an international perspective: curriculum, teachers and pupils (SNILLE)
1982:1	Basic skills in a longterm perspective (BAS)
1982:2	Sign language and the learning of Swedish by deaf children (Project TSD)
1982:3	Preparedness for the future as an educational objective in upper secondary school
1982:4	Maturity levels and selfperception (MOS)
1982:5	Pupils' thinking and course requirements in science teaching (EKNA)
1982:6	Children in Group Day Care and Family care. A longitudinal study of children with different child care experiences.
1983:1	Evaluation of Courses of Study at Upper Secondary School (UTGY)
1983:2	The Research Programme of The National Swedish Board of Education

1. BACKGROUND - The First IEA Science Study

The first IEA¹⁾ Science Study was carried out between 1969 and 1973, with the data collection in 1970 (Comber & Keeves, 1973; Husén et al., 1973). Data were collected from nationally representative probability samples of schools, teachers and students in nineteen countries, including Sweden. The aim of the project was partly to describe the various school systems and partly to attempt to assess factors explaining variations between students, between schools, and between national school systems. The study indicated that the variation in achievement between schools and students is explained mainly by factors lying outside the schools. Students' characteristics and behavior influence their achievement levels much more than school resources, partly because the variation in school resources is very small in Sweden (Noonan, 1976; Noonan, 1982). In comparing Sweden and other industrialized countries, the following findings were made:

- (1) At the 10-year-old level, which in Sweden included grades 3 and 4, the mean science achievement was considerably higher in Sweden than in most other industrialized countries. Sex differences at this level were small in Sweden.
- (2) At the 14-year-old level, which in Sweden included grades 7 and 8, mean science achievement for Swedish students was somewhat lower than the mean for students in other participating industrialized countries. Sex differences had increased substantially.
- (3) It was found that sex differences in favor of the boys for science as a whole were clearly visible already by the beginning of upper primary school. They then increased and became most marked by the end of lower secondary school. The differences were least for biology and greatest in physics, chemistry, and practical skills.

¹⁾ IEA = International Association for the Evaluation of Educational Achievement

- (4) The Swedish school system was found to be the most homogeneous of all school systems examined. Variation between schools in the compulsory school system was least among all participating countries.
- (5) It was found that among 10-year-olds and 14-year-olds, attitudes toward school were rather negative in Sweden as in many other industrialized countries. A closer examination of students' attitudes toward science has yielded several interesting results (Husén & Mattsson, 1978). First no massive negative attitude toward science, of the kind often assumed in the public debate, could be found. Secondly, sex differences in attitudes were uniformly small, which has important consequences for achieving better balance between the sexes in recruitment to natural sciences and technology.

2. A Second IEA Science Study

Educational systems are changeable. The first IEA Science Study was carried out during a period of transition from the compulsory school curriculum Lgr 62 to Lgr 69. A new curriculum, Lgr 80, was instated in the autumn of 1980 and will be implemented in full as of the school year 1982/1983. The SIA¹⁾ reform has led to the decentralization of decision-making and changes in inner work of the school and in the school day. Since the first IEA study the new upper secondary school has come into existence through the merger of the older upper secondary school, continuation school, and vocational school.

Significant changes have also occurred in many other countries which participated in the first science study. Increased decentralization has been implemented in many industrialized countries during the past decade. Changes have occurred in recruitment to upper secondary schooling, with an increasing proportion of the age cohorts remaining in school after the end of compulsory

¹⁾ SIA is short for "skolans inre arbete" which means "the internal organization of school activities".

schooling. It is important to conduct evaluation studies every 10-15 years in order to provide evidence for policy making and in order to better understand the teaching and learning processes and the factors which influence outcomes. For these reasons, IEA is undertaking a new science study.

The international study has three main goals:

- (1) to describe the increased decentralization which has occurred in many countries in recent years and to study the consequences that this decentralization can have;
- (2) to describe the changes which have occurred in many countries in recruitment to upper secondary schooling as well as those changes in primary schooling which have occurred in many countries;
- (3) to describe student achievement in science and attitudes toward science and to compare achievement levels and attitudes with results from the 1970 study.

In the international IEA project the following student populations are defined:

- Population 1: All 10-year-old students attending the regular school system.
- Population 2: All 14-year-old students attending the regular school system.
- Population 3: All students attending the final year of upper secondary school who are studying science.

These populations were established already in the first IEA Science Study and were chosen for both theoretical and practical reasons. Students younger than 10 years old can hardly be studied with the aid of questionnaires. Ten-year-old students in Sweden have not yet studied science as a separate subject. Science knowledge can be interpreted as general knowledge which students have acquired mainly outside the school. In the

industrialized countries which participated in the first study, almost all 14-year-olds attended school, but in some countries selection occurred already at the age of 14-15. It was therefore appropriate to have 14-year-olds in the study in order to provide a measure of the "final product" in terms of knowledge for many students. It was also appropriate to have a measure of the "final product" from students completing the final year of upper secondary school.

The countries which are participating in the Second International Study of Science are Australia, Belgium, Canada, China, England, Finland, Ghana, Hong Kong, Hungary, Israel, Italy, Japan, Korea, the Netherlands, New Zealand, Nigeria, Norway, Papua New Guinea, Philippines, Poland, Sweden, USA, and Zimbabwe. Several other countries are expected to participate eventually.

3. Swedish Participation in the Second International Science Study

Sweden is now participating in the second international study of student achievement and attitudes in science. The Swedish study is to a great extent based on the national situation, but at the same time, by participating in the international study it enables international study comparisons. The purpose of the Swedish study is the following:

- (1) to outline developments since 1970 in the curriculum and in student achievement and attitudes;
- (2) to examine the effects of the implementation of the new curricula for science both in compulsory schooling and in upper secondary schooling (for compulsory schooling the results are to be regarded as "closing of the books" for Lgr 69 and at the same time as a baseline for Lgr 80);
- (3) to evaluate competence levels in basic knowledge in science;
- (4) to examine knowledge in relation to requirements of different "users" of scientific and technical manpower;

- (5) to investigate student attitudes toward science and science in school;
- (6) to study sex differences in achievement and attitudes;
- (7) to investigate the relationship between instructional factors and student achievement and attitudes;
- (8) to make international comparisons concerning student achievement and attitudes toward science.

The following populations are to be tested in Sweden:

- Population 1a: All students in compulsory schooling, grade 3
- Population 1b: All students in compulsory schooling, grade 4
- Population 2a: All students in compulsory schooling, grade 7
- Population 2b: All students in compulsory schooling, grade 8
- Population 2c: All students in compulsory schooling, grade 9
- Population 3a: All students in upper secondary schooling, grade 3, N- and T-lines
- Population 3b: All students in upper secondary schooling, grade 3, S-, H- and E-lines
- Population 3c: All students in upper secondary schooling, grade 2, in the technically oriented vocational lines, i.e., Be, Ba, Du, Et, Fo, Jo, Li, Pr, Sb, Te, Td, Tr, Ve
- Population 3d: All students in upper secondary schooling, grade 2 in all other vocational lines.

Data collection is based on a nationally representative probability sample of schools and classes within the selected schools. The number of students to be tested is shown in the table on next side.

Population	Number tested	% of Population
1a	1,800	1.6
1b	1,800	1.6
2a	2,700	2.4
2b	2,700	2.4
2c	9,300	7.6
3a	4,100	31.6
3b	2,500	15.8
3c	2,900	12.0
3d	2,900	9.1
Sum	30,700	

The timetable for the Swedish study is to a great extent determined by the timetable for the international study. Testing is to take place in April-May 1983. Several partial reports are to be published while the project is under way, and the final report is to be published during the second half of 1985.

4. Connections with Other Research Projects

This project is one component of a more extensive umbrella project, Skola och naturvetenskap i internationell belysning: läroplan, lärare, elever (SNILLE) /Schools and Natural Science in International Perspective: Curricula, Teachers, Students/. The aim of the umbrella project is to study the role of the school in the production of the scientific and technological competence which Sweden - a small country in a much larger world - needs in order to meet a secure future.

Interest in the present study has turned out to be gratifyingly high among school leaders, teachers, and students.

REFERENCES

- Comber, L.C. & J.P. Keeves (1973): Science Education in Nineteen Countries: An Empirical Study. Stockholm: Almqvist & Wiksell.
- Husén, T. et al. (1973): Svensk skola i internationell belysning I.: Naturorienterande ämnen. Stockholm: Almqvist & Wiksell.
- Husén, T. & I. Mattsson (1978): "Ungdomars attityder till naturvetenskapen: En internationell jämförelse" in Per Sörbom (ed.) Attityder till tekniken. Stockholm: Riksbankens Jubileumsfond & Ingenjörsvetenskapsakademien.
- Noonan, R. (1976): School Resources, Social Class, and Student Achievement. Stockholm: Almqvist & Wiksell International.
- Noonan, R. (1972): "School Environments and School Outcomes: An Empirical Comparative Study Using the IEA Data", in M. Niessen & J. Peschar (eds.), Comparative Research on Education. London: Pergamon.